

WHAT IS CLAIMED IS:

1. A battery comprising an electrolyte having lithium ions and a cathode comprising metal vanadium oxide, wherein the battery demonstrates an accessible current capacity of at least about 220 mAh/g upon discharge down to a pulse discharge voltage of 2 V when pulsed in groups of four constant energy pulses at a current density of 30 mA/cm² to deliver 50 Joules per pulse that are separated by 15 seconds of rest between each pulse with 6 days between pulse groups.
2. The battery of claim 1 having an average internal electrical resistance of no more than 0.2 Ohms at a current density of at least about 30mA/cm².
3. The battery of claim 1 wherein the cathode comprises at least about 8 weight percent electrically conductive, electro-chemically inert particles.
4. The battery of claim 1 wherein the cathode comprises at least about 10 weight percent electrically conductive, electro-chemically inert particles.
5. The battery of claim 1 wherein the metal vanadium oxide comprises particles having an average diameter less than about 1000 nm.
6. The method of claim 1 wherein the metal vanadium oxide comprises particles having an average diameter less than about 500 nm.
7. The battery of claim 1 wherein metal vanadium oxide comprises silver vanadium oxide.
8. The battery of claim 7 wherein silver vanadium oxide comprises Ag_xV₂O_y, with $0.3 \leq x \leq 2.0$ and $4.5 \leq y \leq 6.0$.
9. The battery of claim 1 wherein the battery demonstrates an accessible current capacity of at least about 240 mAh/g when pulsed in groups of four constant energy pulses at a current density of 30 mA/cm² to deliver 50 Joules per pulse that are separated by 15 seconds of rest

between each pulse with 6 days between pulse groups, upon discharge down to a pulse discharge voltage of 2 V.

10. The battery of claim 1 wherein the battery demonstrates an accessible current capacity
5 of at least about 250 mAh/g when pulsed in groups of four constant energy pulses at a current density of 30 mA/cm² to deliver 50 Joules per pulse that are separated by 15 seconds of rest between each pulse with 6 days between pulse groups, upon discharge down to a pulse discharge voltage of 2 V.

10 11. The battery of claim 1 wherein the anode comprises lithium metal.

12. The battery of claim 1 wherein pulse trains can be supplied by the battery at current densities greater than about 50 mA/cm².

15 13. The battery of claim 1 wherein the cathode has a thickness from about 0.1 mm to about 0.8 mm.

14. The battery of claim 1 having a charging current to at least about 0.4A per cubic centimeter of battery volume.

20 15. The battery of claim 1 exhibiting no significant voltage delay throughout the life of the battery as demonstrated in a three month accelerated discharge test.

16. An implantable medical device comprising a battery of claim 1.

25 17. An implantable medical device of claim 16 having defibrillating function.

18. An implantable medical device of claim 16 having defibrillating and cardiac pacing functions.

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19. A battery comprising an electrolyte having lithium ions and a cathode comprising metal vanadium oxide particles, the battery having an average internal electrical resistance of no more than 0.2 Ohms at a current density of at least about 30 mA/cm².
- 5 20. The battery of claim 19 wherein the metal vanadium oxide particles comprise silver vanadium oxide.
21. The battery of claim 19 wherein the metal vanadium oxide particles have an average diameter less than about 1000 nm.
- 10 22. The battery of claim 19 wherein the metal vanadium oxide particles have an average diameter less than about 500 nm.
23. The battery of claim 19 having an average internal electrical resistance of no more than
15 0.17 Ohms at a current density of at least 30 mA/cm².
24. The battery of claim 19 having an average internal electrical resistance of no more than 0.15 Ohms at a current density of at least 30 mA/cm².
- 20 25. The battery of claim 19 having an internal electrical resistance of no more than 0.125 Ohms at 2.6V at a current density of at least 30 mA/cm².
26. The battery of claim 19 wherein the anode comprises lithium metal.
- 25 27. The battery of claim 19 having a charging current to about 0.4 amps per cubic centimeter of battery volume.
28. The battery of claim 19 exhibiting no significant voltage delay throughout the life of the battery as demonstrated in a three month accelerated discharge test.

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29. The battery of claim 19 having a volume from about 3 cubic centimeters to about 15 cubic centimeters.

30. An implantable medical device comprising a battery of claim 19.

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31. A battery comprising an electrolyte having lithium ions and a cathode comprising metal vanadium oxide particles, the battery having a current capability of at least about 0.4 amps per cubic centimeter battery volume.

10 32. The battery of claim 31 wherein the metal vanadium oxide particles comprise silver vanadium oxide.

33. The battery of claim 31 wherein the metal vanadium oxide particles have an average diameter less than about 1000 nm.

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34. The battery of claim 31 wherein the metal vanadium oxide particles have an average diameter less than about 500 nm.

35. The battery of claim 31 having an average internal electrical resistance of no more than
20 0.2 Ohms at a current density of at least 30 mA/cm².

36. The battery of claim 31 having a current capability of at least about 0.5 amps per cubic centimeter battery volume.

25 37. The battery of claim 31 wherein the battery has a volume no more than 15 cubic centimeters.

38. The battery of claim 31 wherein the battery has a volume from about 3 cubic centimeters to about 10 cubic centimeters.

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39. The battery of claim 31 exhibiting no significant voltage delay throughout the life of the battery as demonstrated in a three month accelerated discharge test.

40. A battery comprising an electrolyte comprising lithium ions and a cathode comprising metal vanadium oxide particles, the battery exhibiting no significant voltage delay throughout the life of the battery as demonstrated in a three month accelerated discharge test.

41. The battery of claim 40 wherein the metal vanadium oxide particles comprise silver vanadium oxide.

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42. The battery of claim 40 wherein the metal vanadium oxide particles have an average diameter less than about 1000 nm.

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43. The battery of claim 40 wherein the metal vanadium oxide particles have an average diameter less than about 500 nm.

44. The battery of claim 40 having an average internal electrical resistance of no more than 0.2 Ohms at a current density of at least 30 mA/cm².

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45. The battery of claim 40 having an average charging current to at least about 0.5 amps per cubic centimeter battery volume.

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46. A battery comprising an electrolyte comprising lithium ions and a cathode comprising metal vanadium oxide particles, the battery having a pulse voltage of no less than 2.25V at a pulse current density of 30 mA/cm² when discharged to a voltage of 2.6V.

47. The battery of claim 46 wherein the pulse voltage is from about 2.3V to about 2.4V at a pulse current density of 30 mA/cm² when discharged to a voltage of 2.6V.

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48. The battery of claim 46 wherein the metal vanadium oxide particles comprise silver vanadium oxide.

49. The battery of claim 46 wherein metal vanadium oxide particles have an average diameter no more than about 1000 nm.

50. The battery of claim 46 wherein metal vanadium oxide particles have an average
5 diameter no more than about 500 nm.

51. The battery of claim 46 having an internal electrical resistance of no more than 0.2 Ohms at a current density of at least about 30 mA/cm².

10 52. The battery of claim 46 having an average charging current of at least about 0.5 amps per cubic centimeter battery volume.